Universidade Federal do ABC
Fundamentos de Processamento Gráfico 2023.3
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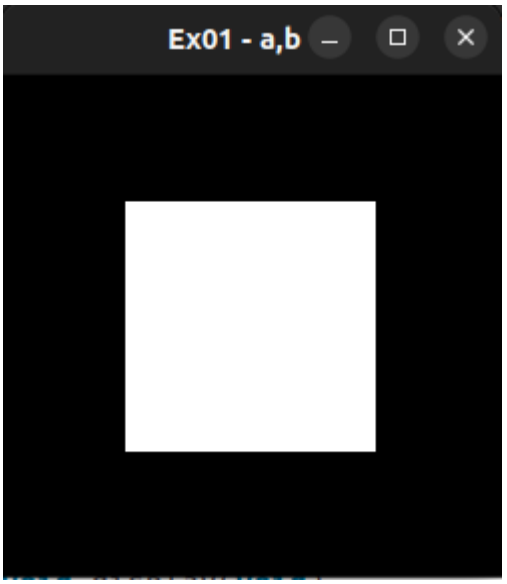
Laboratório 02 - Prática com OpenGL

Através da API gráfica OpenGL e sua estrutura mínima de programa, é possível renderizar um quadrado simples bidimensional utilizando os comandos: glColor(), glVertex(), glBegin(), glEnd() e glFlush(), passando como argumento as tuplas de vértices e cores, bem como o objeto a ser renderizado ao comando glBegin():

```
glClear (GL_COLOR_BUFFER_BIT);
glColor3f (1.0, 1.0, 1.0);
glBegin(GL_POLYGON);
    glVertex3f (0.25, 0.25, 0.0);
    glVertex3f (0.75, 0.25, 0.0);
    glVertex3f (0.75, 0.75, 0.0);
    glVertex3f (0.25, 0.75, 0.0);
glEnd();
glFlush ();
```

Resultado (itens *a* e *b*):

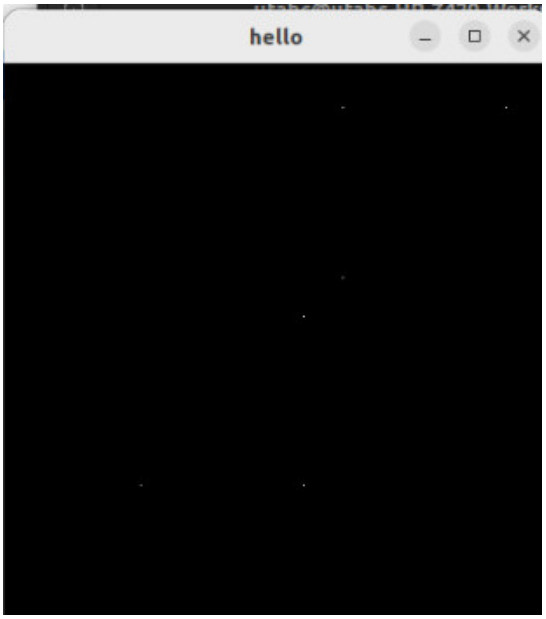


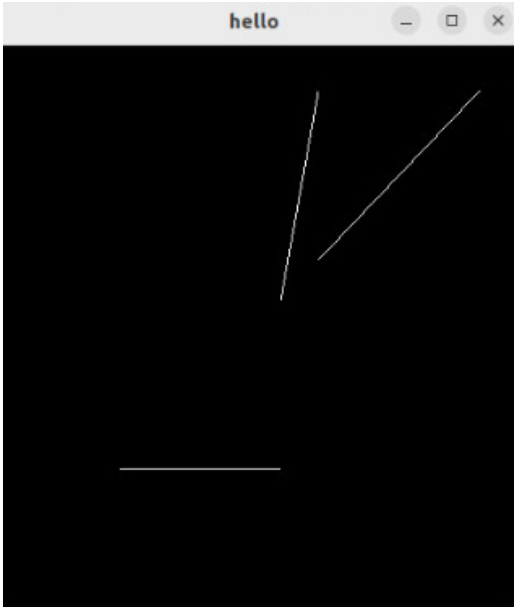
Passando diferentes constantes da API para a função glBegin(), é possível gerar diferentes imagens com os mesmos vértices e cores definidos:

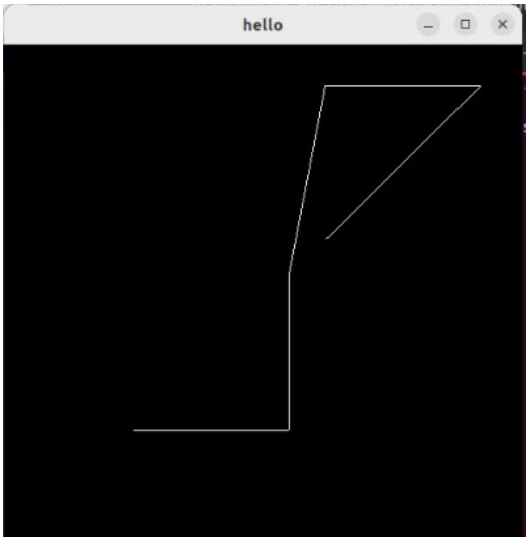
EXERCÍCIO C

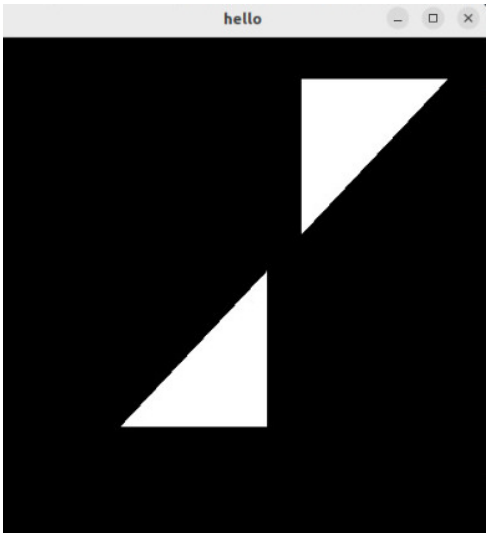
Para que ficasse mais claro à diferença entre cada um dos comandos, alteramos o código de maneira a formar dois triângulos, e à partir dessas coordenadas fomos aplicando as primitivas

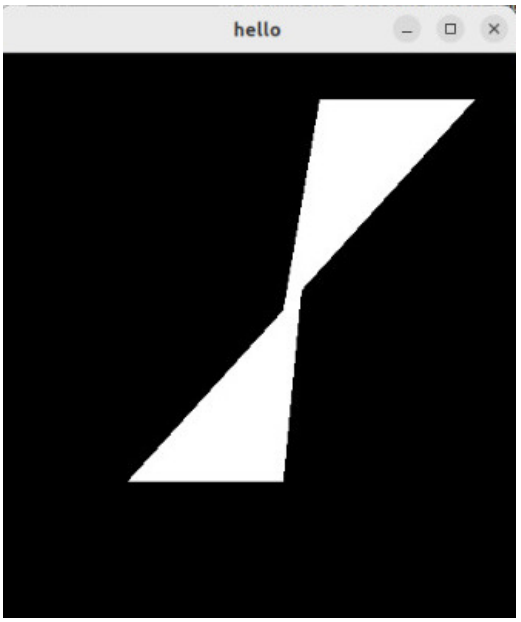
```
glColor3f (1.0, 1.0, 1.0);
glBegin(GL_LINE_STRIP);
    glVertex3f (0.25, 0.25, 0.0);
    glVertex3f (0.55, 0.25, 0.0);
    glVertex3f (0.55, 0.55, 0.0);
    glVertex3f (0.62, 0.92, 0.0);
    glVertex3f (0.92, 0.92, 0.0);
    glVertex3f (0.62, 0.62, 0.0);
glEnd();
```

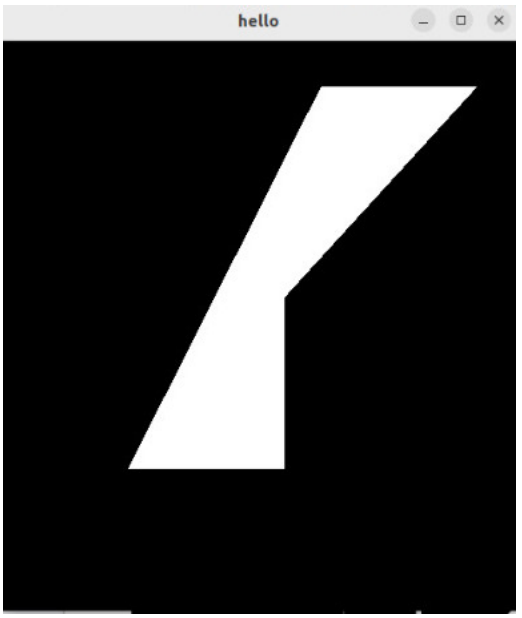


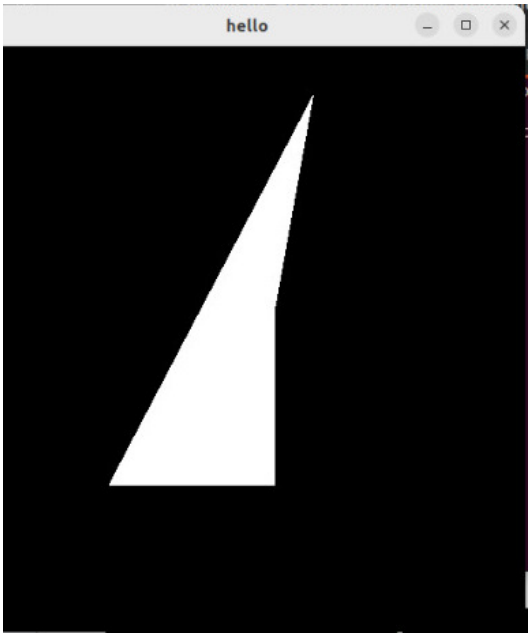




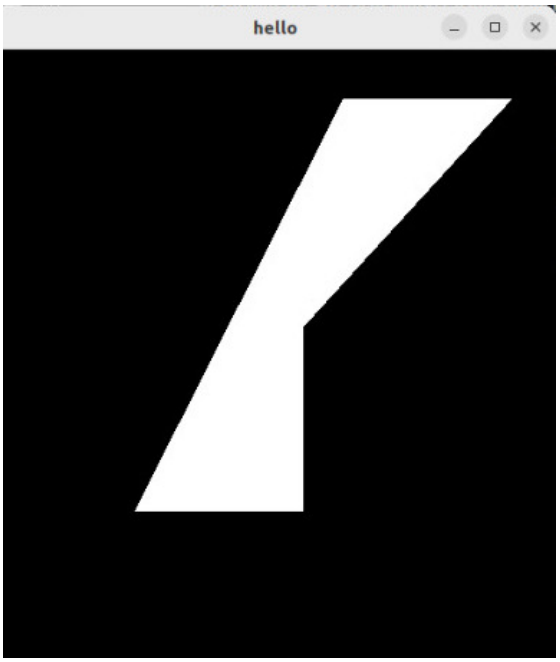



hello


hello

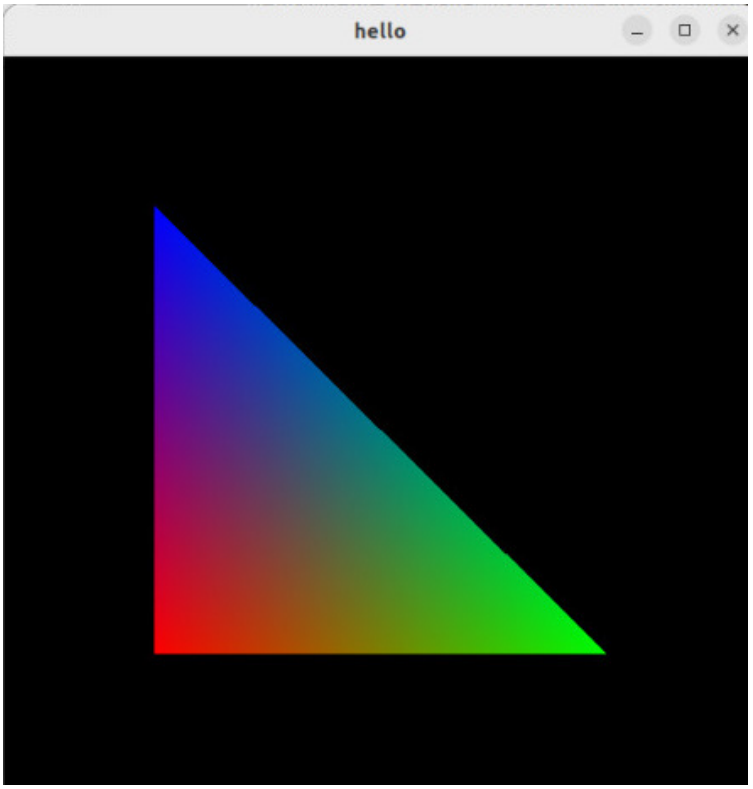

hello


hello

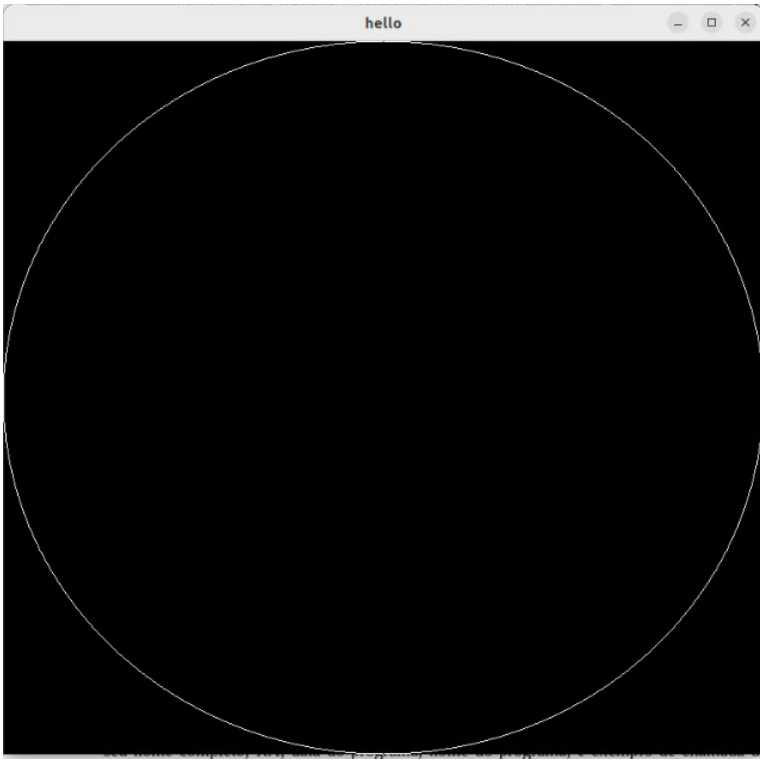

hello

Os resultados acima foram obtidos utilizando as primitivas, GL_POINTS, GL_LINES, GL_LINE_STRIP, GL_LINE_LOOP, GL_TRIANGLES, GL_TRIANGLE_STRIP, GL_TRIANGLE_FAN, GL_QUADS, GL_QUAD_STRIP, GL_POLYGON, respectivamente.

EXERCÍCIO D



EXERCÍCIO E

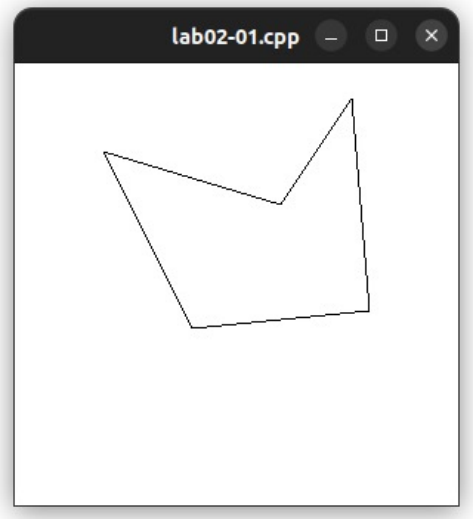


EXERCÍCIOS PARA ENTREGAR

1-

```
/*
 * lab02-01.cpp
 * Heitor Rodrigues Savegnago - 11077415 - 2023-10-10
 * gcc lab02-02.cpp -o /tmp/temp.run -lm -lglut -lGL -lGLU && /tmp/temp.run
 */
#include <GL/gl.h>
#include <GL/glu.h>
#include <GL/glut.h>
#include <stdlib.h>
#include <math.h>

// Função callback chamada para fazer o desenho
void Desenha(void)
{
	// Limpa a janela de visualização com a cor de fundo especificada
	glClear(GL_COLOR_BUFFER_BIT);

	glBegin(GL_LINE_LOOP);

	glColor3f(0.0, 0.0, 0.0);
	glVertex2f(0.0f, 0.0f);
	glVertex2f(0.25f, -0.5f);
	glVertex2f(0.75f, -0.45f);
	glVertex2f(0.7f, 0.15f);
	glVertex2f(0.5f, -0.15f);
	glEnd();

	// Executa os comandos OpenGL
	glFlush();
}
// Inicializa parâmetros de rendering
void Inicializa(void)
{
	// Define a cor de fundo da janela de visualização como preta
	glClearColor(1.0f, 1.0f, 1.0f, 1.0f);
	glOrtho(-0.25, 1, -1, 0.25, -1.0, 1.0);
}
// Programa Principal
int main(int argc, char *argv[])
{
	glutInit(&argc, argv);
	glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
	glutCreateWindow("lab02-01.cpp");
	glutDisplayFunc(Desenha);
	Inicializa();
	glutMainLoop();
	return 0;
```

}

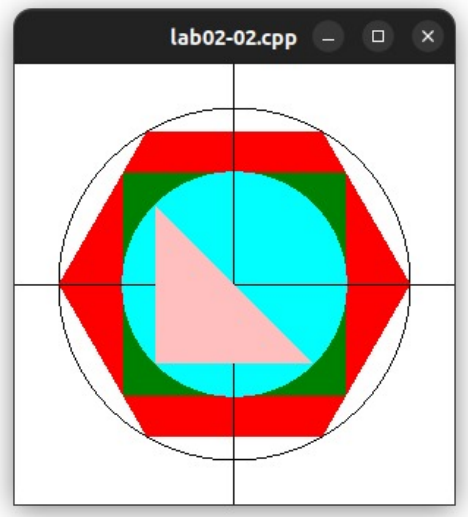


2-

```
/*
 * lab02-02.cpp
 * Heitor Rodrigues Savegnago - 11077415 - 2023-10-10
 * gcc lab02-02.cpp -o /tmp/temp.run -lm -lglut -lGL -lGLU && /tmp/temp.run
 */
#include <GL/gl.h>
#include <GL/glu.h>
#include <GL/glut.h>
#include <stdlib.h>
#include <math.h>

// Função callback chamada para fazer o desenho
void Desenha(void)
{
	// Limpa a janela de visualização com a cor de fundo especificada
	glClear(GL_COLOR_BUFFER_BIT);

	// glBegin(GL_POLYGON);
	//	glVertex3f(0.25f, 0.25f, 0.0f);
	//	glVertex3f(0.75f, 0.25f, 0.0f);
	//	glVertex3f(0.75f, 0.75f, 0.0f);
	//	glVertex3f(0.25f, 0.75f, 0.0f);
	// glEnd();

	// glBegin(GL_TRIANGLES);
	//	glColor3f(1.f, 0.f, 0.f);
	//	glVertex3f(0.2f, 0.2f, 0.f);
	//	glColor3f(0.f, 1.f, 0.f);
	//	glVertex3f(0.8f, 0.2f, 0.f);
	//	glColor3f(0.f, 0.f, 1.f);
	//	glVertex3f(0.2f, 0.8f, 0.f);
	// glEnd();
```

```
GLdouble PI = 3.1415926535897;
GLint circle_points = 100;
GLdouble radius = 1;

glBegin(GL_LINE_LOOP); // Circulo
for (int i = 0; i < circle_points; i++)
{
float angle = 2 * PI * i / circle_points;
glColor3f(0.0, 0.0, 0.0);
glVertex2f(radius*cos(angle), radius*sin(angle));
}
glEnd();

glBegin(GL_POLYGON); //Hexagono
for (int i = 0; i < 360; i += 60 )
{
float angle = i * PI / 180.0;
glColor3f(1.0, 0.0, 0.0);
glVertex2f(radius*cos(angle), radius*sin(angle));
}
glEnd();

radius = 0.9;

glBegin(GL_POLYGON); //Quadrado
for (int i = 45; i < 360; i += 90 )
{
float angle = i * PI / 180.0;
glColor3f(0.0, 0.5, 0.0);
glVertex2f(radius*cos(angle), radius*sin(angle));
}
glEnd();

radius = 0.64;

glBegin(GL_POLYGON); // Circulo
for (int i = 0; i < circle_points; i++)
{
float angle = 2 * PI * i / circle_points;
glColor3f(0.0, 1.0, 1.0);
glVertex2f(radius*cos(angle), radius*sin(angle));
}
glEnd();

glBegin(GL_LINES); // Circulo
// for (int i = 0; i < circle_points; i++)
// {
// float angle = 2 * PI * i / circle_points;
glColor3f(0.0, 0.0, 0.0);
glVertex2f(-1.25,0);
glVertex2f(1.25,0);
glVertex2f(0,-1.25);
glVertex2f(0,1.25);
```

```
        // }
        glEnd();

        glBegin(GL_POLYGON); //Triangulo retangulo
        for (int i = 135; i < 360; i += 90 )
        {
        float angle = i * PI / 180.0;
        glColor3f(1.0, 0.75, 0.75);
        glVertex2f(radius*cos(angle), radius*sin(angle));
        }
        glEnd();

        // Executa os comandos OpenGL
        glFlush();
}
// Inicializa parâmetros de rendering
void Inicializa(void)
{
        // Define a cor de fundo da janela de visualização como preta
        // glClearColor(0.0f, 0.0f, 0.0f, 1.0f);
        glClearColor(1.0f, 1.0f, 1.0f, 1.0f);
        glOrtho(-1.25, 1.25, -1.25, 1.25, -1.25, 1.25);
}
// Programa Principal
int main(int argc, char *argv[])
{
        glutInit(&argc, argv);
        glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
        glutCreateWindow("lab02-02.cpp");
        glutDisplayFunc(Desenha);
        Inicializa();
        glutMainLoop();
        return 0;
}
```



Referências: